

SECTION 5

SECTION 5 STORMWATER

5.1 OVERVIEW

The stormwater management system is designed to promote the collection of runoff from various locations at TRQR and will attenuate site runoff from up to and including the 100-year storm event. The stormwater management system for TRQR was also designed in accordance with DEP's *Stormwater Management Standards*. To comply with the standards, an integrated system of collection, detention/retention, and infiltration/recharge was designed to maintain developed peak runoff rates at or less than those experienced under existing watershed conditions. The integrated stormwater management system was also designed to collect and treat runoff generated by the proposed development with deep sump catch basins, *Stormceptor* treatment units, stormwater basins and swales, and the recharge of roof runoff. The implementation of a comprehensive approach to the treatment of runoff, in accordance with the *best management practices* of DEP's *Stormwater Management Standards*, the reduction of the golf course from 18- to 9-holes while maintaining current pesticide and herbicide management practices, and the continued collection and treatment of runoff that flows overland contribute to the goal of ensuring that the water quality of stormwater discharges, and as a result that of receiving waters, is maintained and improved to the maximum extent possible.

The design of the stormwater management system was approved by the APB as part of the Special Permit process. As discussed above, an NOI was submitted to the ACC in January of 2008 and the hearing extended until vehicular access alternative studies have been concluded. The Commission has reviewed the stormwater design and approval is anticipated with the issuance of an Order of Conditions.

5.1.1 Stormwater Management System Description

The stormwater management system consists of three primary contributing components. The first component was constructed in conjunction with the Quail Ridge Country Club 18-hole golf course and will remain in place to collect and treat runoff from the remaining 9-hole golf course. This system was the subject of the original permitting process and is comprised of a number of detention basins, infiltration basins, detention ponds and area drains. These components will be left largely intact, with slight modifications to improve their functionality.

The second component was also constructed in conjunction with QRCC and is associated with the existing parking lot located near the SCS. It is comprised of deep sump hooded catch basins, a piping system, drainage swales, sediment forebays, and a *Stormceptor* proprietary treatment unit. Figures 5-01, 5-02 and 5-03 show the layout of the stormwater drainage system. The various Best Management Practices (BMP's) have been identified on the plan.

The third component is the proposed stormwater management system that is associated with the construction of the new buildings and infrastructure. It is described in detail below.

Hydrologic modeling and design calculations were based on the current NRCS soil survey report for Middlesex County and associated soil maps for Acton and Boxborough. This report indicates that soils on the site consist of Scarboro mucky fine sand loam, Wareham loamy fine

PROPOSED INFILTRATION BASIN #12

SUBCATCHMENT 36

SUBCATCHMENT 12

PROPOSED FLARED END (TYP.)

PROPOSED CATCH BASIN (TYP.)

PROPOSED DRAIN MANHOLE (TYP.)

SUBCATCHMENT 6

PROPOSED CULTEC ROOF DRAIN DRYWELL (TYP.)

SUBCATCHMENT 8

PROPOSED WATER QUALITY SWALE #10

PROPOSED WATER QUALITY SWALE #11

PROPOSED DROP INLET (TYP.)

SUBCATCHMENT 1

PROPOSED WATER QUALITY SWALE #9

SUBCATCHMENT 1

PROPOSED ADS N-12 DRAINLINE (TYP.)

PROPOSED INFILTRATION BASIN #31

SUBCATCHMENT 2

PROPOSED DETENTION BASIN #13

PROPOSED STORMSEPTOR-2400 PROPRIETARY SEPARATOR

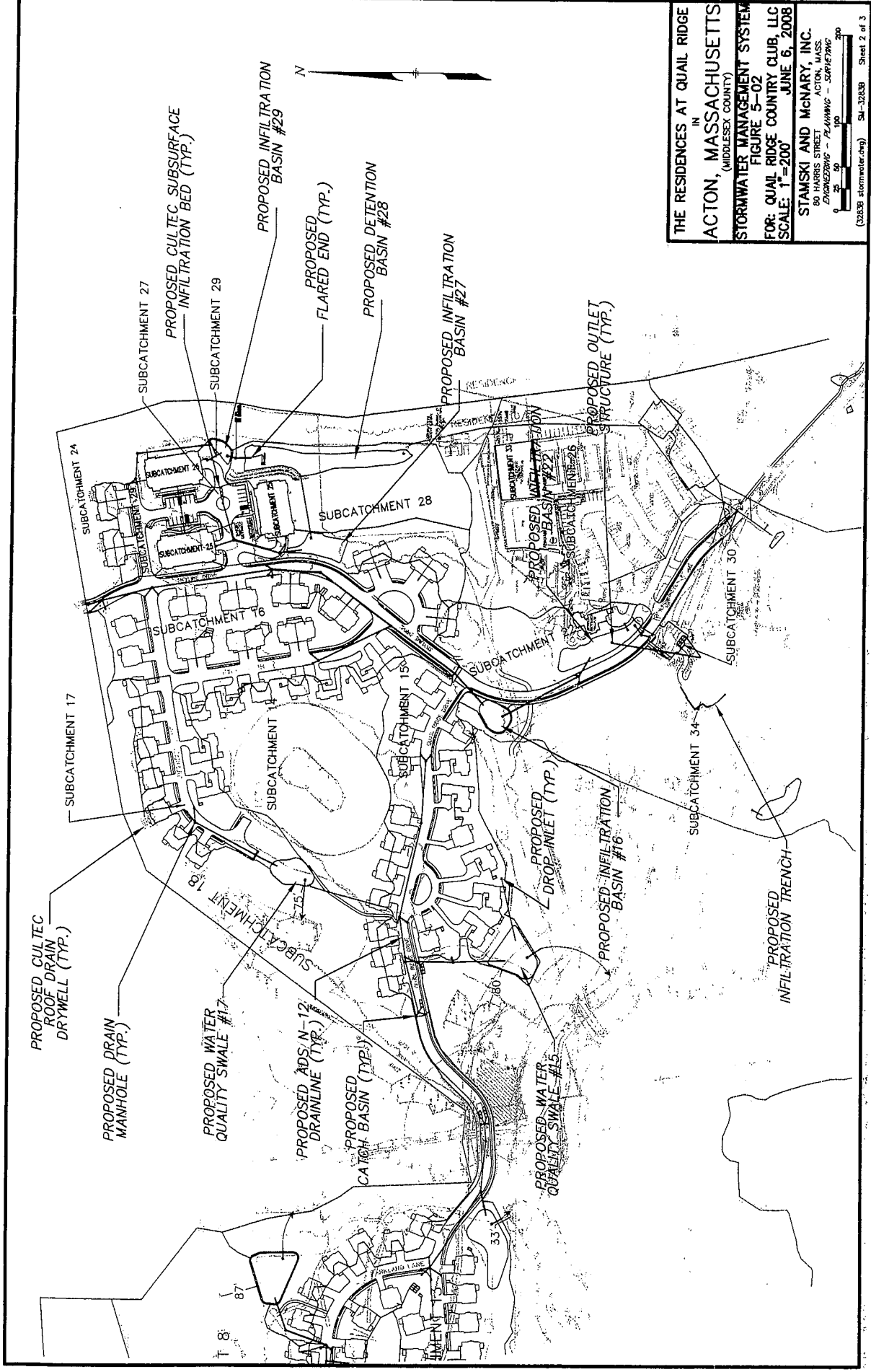
PROPOSED OUTLET STRUCTURE (TYP.)

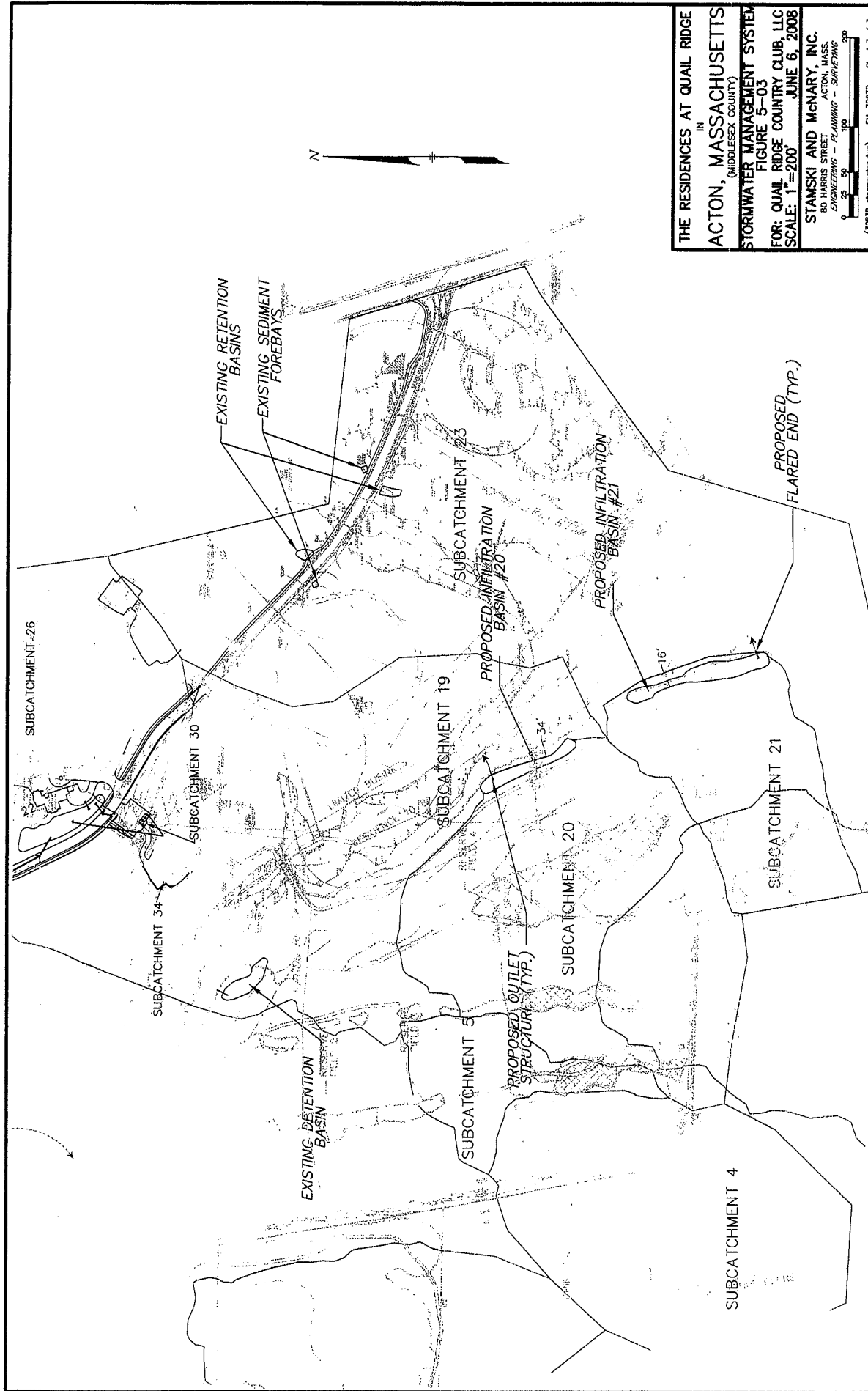
PROPOSED CULTEC SUBSURFACE INFILTRATION BED (TYP.)



THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
STORMWATER MANAGEMENT SYSTEM
FIGURE 5-01
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200'
JUNE 6, 2008
STAMSKI AND McNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
0 125 250 500 1000
(32839 stormwater.dwg) - SN-32839 - Sheet 1 of 3

THE RESIDENCES AT QUAIL RIDGE
 IN
 ACTON, MASSACHUSETTS
 (MIDDLESEX COUNTY)
 STORMWATER MANAGEMENT SYSTEM
 FIGURE S-02
 FOR: QUAIL RIDGE COUNTRY CLUB, LLC
 SCALE: 1"=200'
 JUNE 6, 2008
 STAMSKI AND McNARY, INC.
 80 HARRIS STREET
 ACTON, MASS.
 ENGINEERING - PLANNING - SCAPETWORK
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 (32258 stormwater.dwg) S4-322538 Sheet 2 of 3





THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
STORMWATER MANAGEMENT SYSTEM
FIGURE 5-03
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200' JUNE 6, 2008
STAMSKI AND McNARY, INC.
80 HARRIS STREET ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
(3283B stormwater.dwg) SA-3283B Sheet 3 of 3

sand, Whitman fine sand loan, Charlton-Hollis-Rock outcrop complex, Hollis-Rock outcrop-Charlton complex Hinckley loamy sand, and Scituate fine sandy loam. These soils have been assigned to Hydrologic Groups D, C, D, B, C, A, and C respectively. Prior to analysis, NRCS soils maps were confirmed through on-site soil evaluations, surface cover surveys and wetland delineations.

5.2 Drainage Design

5.2.1 Existing Conditions

The Pre-Development Drainage Analysis was based on the site conditions that existed prior to the development of the 18-hole Quail Ridge Country Club. This approach ensures that the most conservative mitigation measures will be employed for stormwater runoff. At that time, the surface coverage consisted of a dog kennel, wetlands, some open grass areas, and primarily woods. Skyline Drive was essentially a driveway and there were three single family dwellings off of the present site. All off-site and on-site areas have been taken into consideration in order to analyze the Post-Development Site completely. Figure 1-2 shows existing site conditions. Figures 5-04, 5-05, and 5-06 depict existing conditions watersheds.

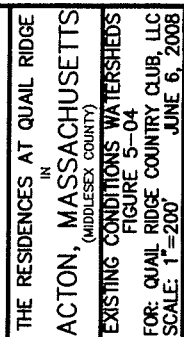
Nagog Brook roughly bisects the site. Will's Hole Brook flows through the site and joins Nagog Brook prior to flowing into Nashoba Brook. All runoff from the site drains to the downstream point where Nagog Brook leaves the property. Pre- and post-development hydrologic modeling and related analysis reflect this design point location and demonstrate that the proposed stormwater management system incorporates mitigation measures sufficient to ensure that there will be no downstream impacts and that on and off-site wetlands will not be impacted by changes in drainage patterns. Figures 5-01, 5-02, and 5-03, Stormwater Management System, depicts the location of all detention/infiltration basins and other components of the stormwater management system and their distance to wetland resource areas.

5.2.2 Developed Conditions

The fully developed site will consist of 174 units of senior housing dispersed into 12-unit, 2-unit and single unit buildings with an associated roadway system. A small proposed parking area and mail station will serve the dwellings. The site will also contain a new restaurant building in a location that was previously slated for a large clubhouse. The existing Family Center, Maintenance Building, tennis courts, pool and parking lot will be preserved. Nine of the eighteen holes will remain on the site for golf. Several detention basins and ponds will remain in place as well. The final stormwater management system has been designed in accordance with the BMPs of DEP's *Stormwater Management Standards* to meet all water quantity and quality standards. Figure 1-3 shows developed site conditions. Figures 5-07, 5-08, and 5-09 depict developed conditions watersheds.

5.2.2.1 Alternatives and Impacts

The proposed drainage system has been designed in a manner that employs Low Impact Development (LID) BMP's and site design. LID site planning strategies identify site specific, environmentally sensitive natural features and conservation areas. Early in the design process of TRQR, the extent and location of onsite wetland resources were considered and incorporated into the conceptual layout of the development drainage system. A field survey of the golf course



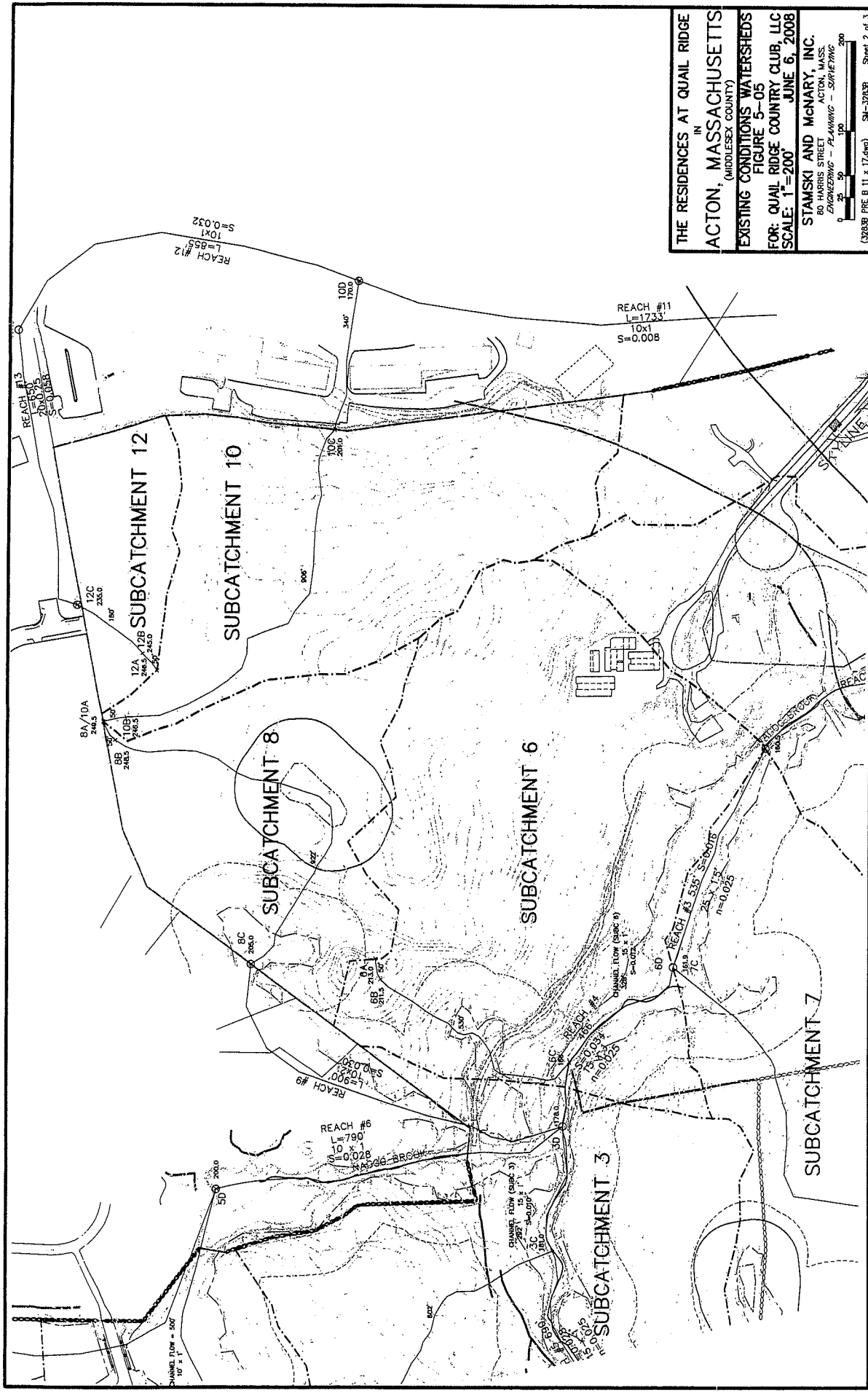
STAMSKI AND McNARY, INC.

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80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING

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38 PRE B 11 x 17.dwg) SM-32838 Sheet 1 of 1

(32838 PRE B 11 x 17.dwg) SM-32838 Sheet 1 of 3



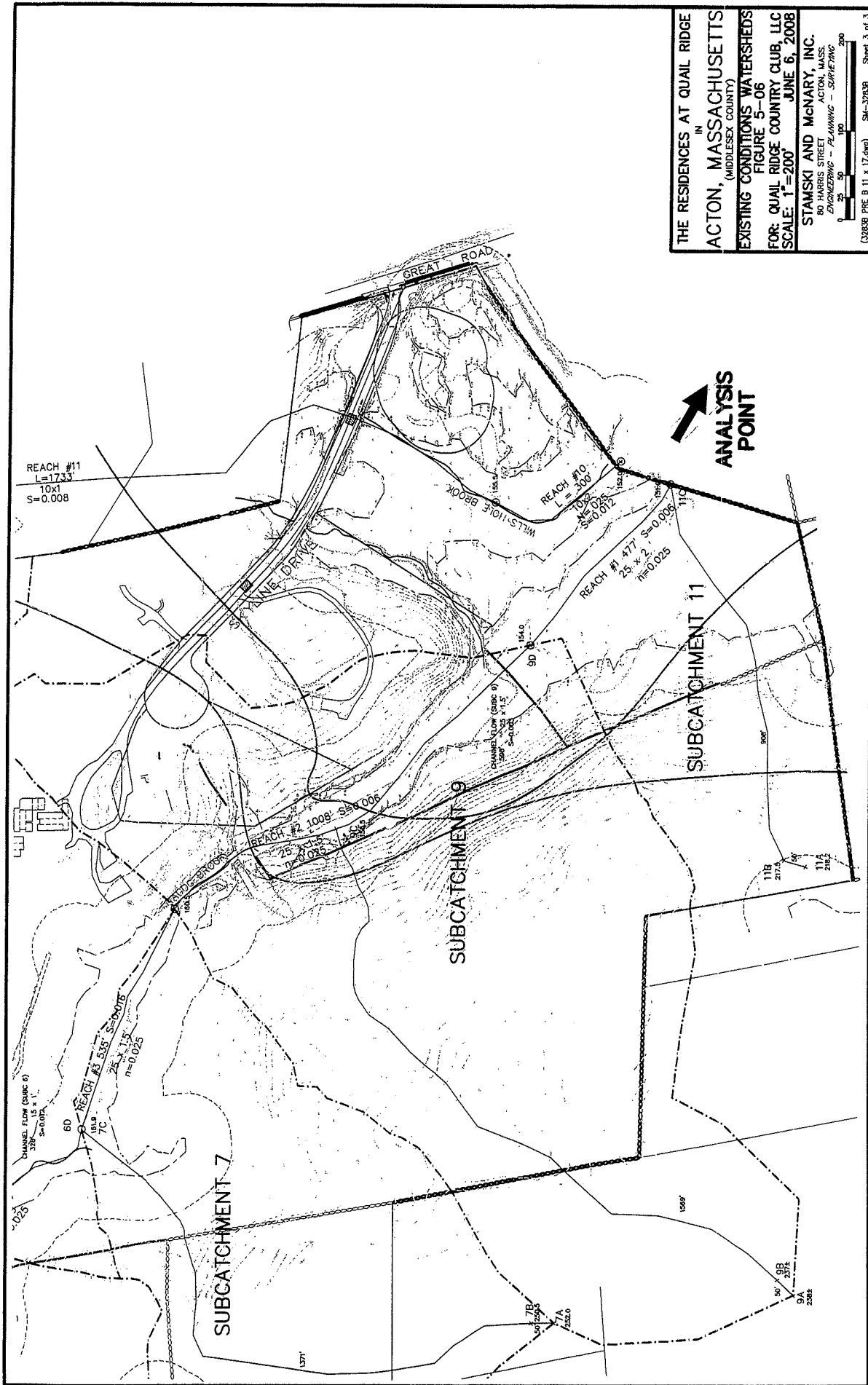
THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING CONDITIONS WATERSHEDS
FIGURE 5-05

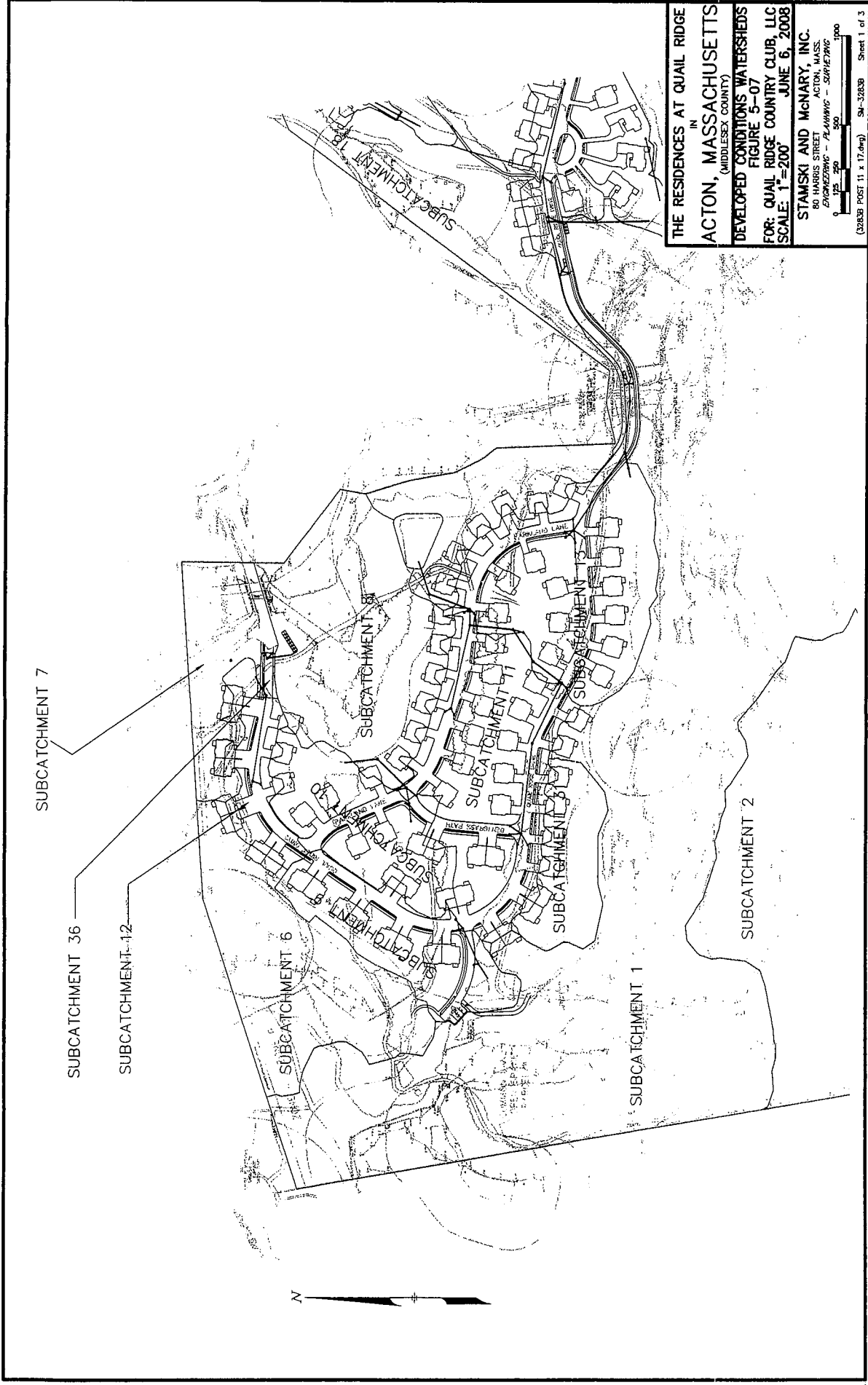
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200' JUNE 6, 2008

STAMSKI AND McNARY, INC.
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ACTON, MASSACHUSETTS 01910
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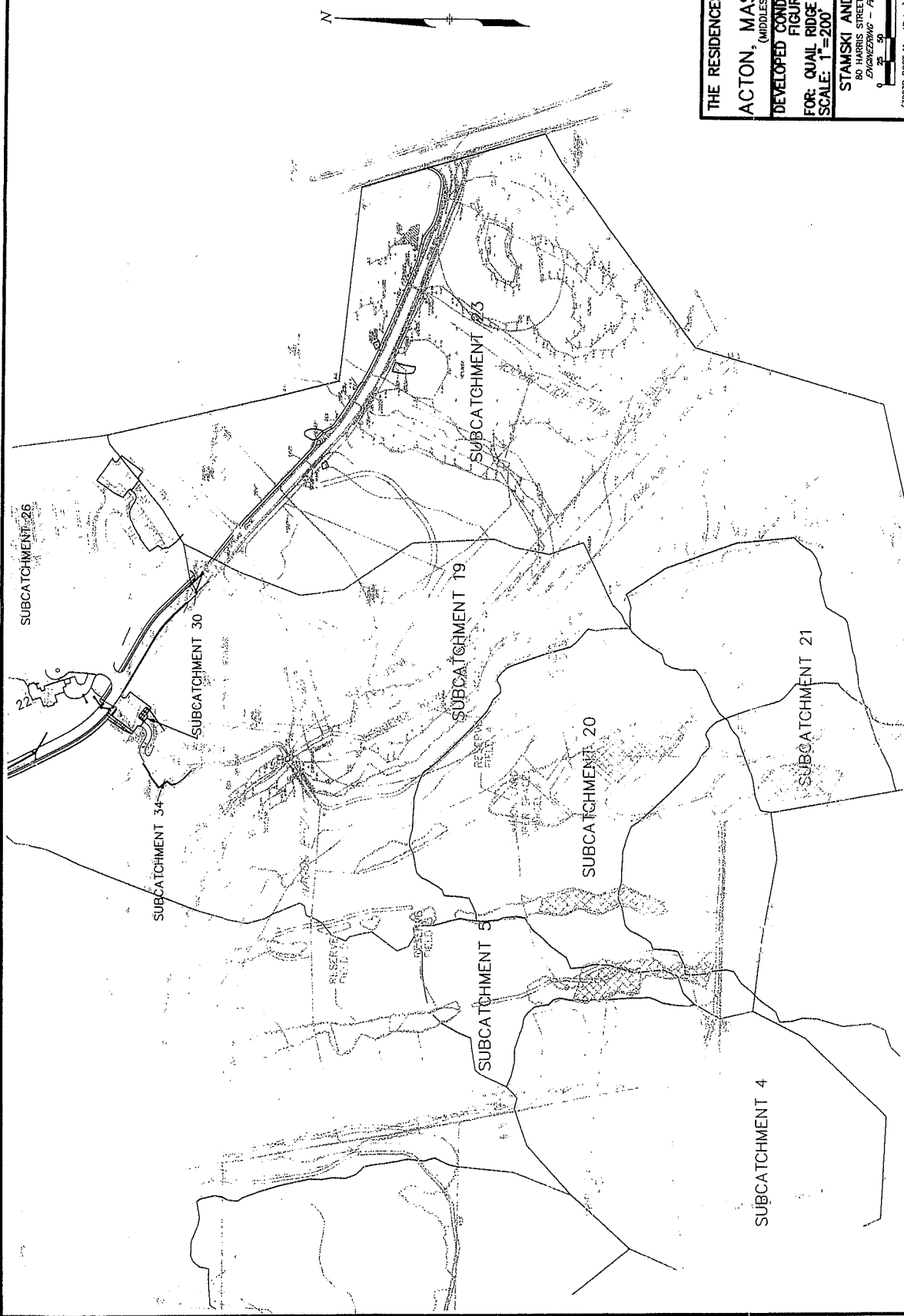
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THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
EXISTING CONDITIONS WATERSHEDS
FIGURE 5-06
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200'
JUNE 6, 2008
STAMSKI AND McNARY, INC.
ACTON, MASS.
810 HARRIS STREET
ENGINEERING - PLANNING - SURVEYING
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THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
DEVELOPED CONDITIONS WATERSHEDS
FIGURE 5-07
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200'
JUNE 6, 2008
STAMSKI AND McNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
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THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
DEVELOPED CONDITIONS WATERSHEDS
FIGURE 5-09
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200' JUNE 6, 2008
STAMSKI AND McNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
3083B POST 11 x 17.dwg SA-3083B Sheet 3 of 3

was conducted in order to develop roadway, building and drainage system layouts that avoided impacts on wetland resources and open space areas to remain. A detailed topographic analysis was conducted to identify natural depressions that might be appropriate for stormwater management, including stormwater basins that had been constructed in conjunction with the golf course. In several instances existing drainage facilities were located close to resource areas and, therefore, necessary expansions of stormwater basins were designed to ensure no further encroachment into buffer zones. As shown on Figures 5-01, 5-02, and 5-03, Stormwater Management System, stormwater basins and BMP's are dispersed throughout the site.

Historically, conventional developments concentrated stormwater runoff controls in a few large stormwater basins in order to mitigate peak rates of runoff. For example, the subdivisions designed prior to the implementation of the Stormwater Management Standards and the current LID methodology generally consisted of catch basin to manhole to detention basin designs with decentralized stormwater management discouraged due to difficulties with and the lack of requirements for long term maintenance. This generally resulted in designs that did not maximize groundwater recharge and yielded large detention basins that, while providing effective peak runoff control and some stormwater treatment did not achieve the contemporary goals of LID (such as limiting land disturbance; treating stormwater in numerous, smaller, decentralized structures; lengthening travel paths to increase time of concentration and attenuate peaks; etc). Implementation of LID techniques continues to control peak rates of runoff while improving the efficiency and effectiveness of stormwater treatment and limiting the impact of stormwater management systems on natural site features.

In accordance with DEP's *Stormwater Management Standards* and contemporary LID principles and techniques, the stormwater management system design for TRQR provides for multiple decentralized structures. These include filter strips, roof drain drywells, infiltration trenches, water quality swales, proprietary Stormceptor treatment units, and infiltration basins. The use of these methods significantly minimizes the impacts associated with former practices that directly discharged runoff from impervious surfaces and minimizes the land area requirement associated with conventional detention basins. The LID micromanagement approach to stormwater is now practical with increased attention to operation and maintenance requirements of the *Stormwater Management Standards*.

5.2.3 Water Quality

As discussed above, the integrated stormwater management system is designed in accordance with DEP's *Stormwater Management Standards* and contemporary LID principles and practices.

The design of the proposed stormwater management system will incorporate state of the art BMPs, principles, and practices to ensure that the water quality of site-related stormwater discharges and related discharges to receiving waters achieves stringent contemporary standards. To achieve compliance, the proposed stormwater system will employ the following components:

- The existing 18-hole golf course will be reduced to 9-holes. Contemporary integrated pesticide and herbicide management practices will continue to be implemented on the remaining 9 golf holes to ensure that water quality benefits are maintained.
- Groundwater recharge will be maximized to the maximum possible extent through the collection of runoff and subsequent discharge via infiltration through a dispersed system

of dry wells, infiltration trenches, infiltration basins, water quality swales and vegetated surfaces.

- Runoff generated by all impervious surfaces and much of the vegetated and landscaped areas associated with the proposed development will be collected by an integrated system of catch basins, surface swales, and stormwater basins. All collected runoff will be treated in accordance with DEP and contemporary LID stormwater management design guidelines and standards. Treatment of collected runoff will be achieved through the periodic street cleaning set forth in the O&M Plan and the use of deep sump catch basins, filter strips, infiltration trenches, water quality swales, *Stormceptor* treatment units, and infiltration basins.

The implementation of a comprehensive approach to the treatment of runoff in accordance with the *best management practices* of DEP's *Stormwater Management Standards*, the reduction of the golf course from 18 to 9-holes while maintaining current pesticide and herbicide management practices, and the continued collection and treatment of runoff that flows overland contribute to the goal of ensuring that the water quality of stormwater discharges, and as a result that of receiving waters, is maintained and improved to the maximum extent possible.

Winter de-icing and sanding conditions

To ensure that water quality is not impacted negatively during winter months of snow and ice, chemical de-icing agents will be limited to calcium chloride during snowplowing operation. As reflected in the stormwater O&M plan, sand used to manage winter road conditions intercepted by and accumulated in deep sump catch basins, water quality swales, and stormwater basins will be removed each spring and disposed of in accordance with acceptable management practices.

5.2 COMPLIANCE WITH DEP STORMWATER MANAGEMENT STANDARDS

The project is subject to the DEP Stormwater Management Standards since there are point source discharges within jurisdictional areas of the Wetlands Protection Act and Rivers Act.

5.2.1 Stormwater Discharges

Standard #1 Untreated Direct Discharge of Stormwater: No new direct discharges of untreated stormwater are proposed. Runoff from the point source will be treated with BMPs prior to discharge.

State of the art treatment of runoff will be achieved through the implementation of a combination of BMP's. These include catch basins, *Stormceptor* units, infiltration basins, infiltration trenches, roof drain infiltration structures, water quality swales, detention basins and street sweeping. There is also an irrigation pond, which will receive and contain runoff from up to the 100 year storm event. This pond is lined with clay to retain water for future use with the exception of several feet of the highest stages where runoff can infiltrate during peak water levels.

Standard #2 Post-Development Peak Discharge: This standard requires that peak discharge rates for the 2-year and 10-year storm events not be increased from pre-development

conditions and that the 100-year storm event will not increase flooding impacts offsite. Attenuation of peak discharge rates has been accomplished through infiltration and detention. The following table summarizes pre- and post development peak rates of runoff for the project.

Table 5-1 Discharge Summary

2 year storm		10 year storm		100 year storm	
Pre-Development	Post-Development	Pre-Development	Post-Development	Pre-Development	Post-Development
33.88 cfs	33.15 cfs	126.52 cfs	114.29 cfs	302.33 cfs	271.93 cfs

(Note: Analysis point is located where Nagog Brook crosses the property line.)

As noted in the table, post-development rates of runoff from all of the storm events are equal to or less than those experienced under pre-development conditions. This analysis was based on the pre-development conditions prior to construction of the Quail Ridge Country Club in order to yield the most conservative results. Detailed calculations are provided in Appendix A.

Standard #3 Groundwater Recharge: This standard prescribes the stormwater volume that must be recharged to groundwater based on the existing site soil conditions. The NRCS, (formerly SCS) Middlesex Soils map indicates that the site contains soils in hydrologic groups A, B, C, and D. This standard requires that for impervious surfaces, 0.60, 0.35, 0.25 and 0.10 inches of runoff respectively for each hydrologic soils group be recharged. Further, the Town of Acton requires a balancing of the annual water budget to preserve groundwater supply. Detailed "Water Balance Calculations" showing compliance with this standard are provided in Appendix A. As shown by these calculations, the requirements of the Town are more stringent than Standard #3 resulting in recharge volumes that exceed the minimum volume requirements.

Runoff from a majority of the roofs is being recharged. Through careful design, the only roofs not being recharged are found in areas that are lower in grade (i.e., in cut) and will not, therefore, provide the requisite separation from the bottom of a dry well to the groundwater.

Standard #4 - 80% Total Suspended Solids Removal (TSS):

This standard requires 80% TSS removal for the total increase in impervious area associated with the project. After removing 80% of the TSS, the discharge is presumed to be suitable for the resource area that will ultimately receive the runoff. This standard is met when:

- a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;

TRQR Design Provision: A long-term pollution prevention plan has been incorporated into the Operation and Maintenance Plan outlined in Standard #9.

b. Stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook;

TRQR Design Provision: The project has been designed in accordance with the applicable Stormwater Management Handbook that was in effect at the time of submission of the Notice of Intent to the Acton Conservation Commission on January 3, 2008.

c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

TRQR Design Provision: The project has been designed in accordance with the applicable Stormwater Management Handbook that was in effect at the time of submission of the Notice of Intent to the Acton Conservation Commission on January 3, 2008.

This standard requires 0.5 inches of runoff from impervious surfaces to be treated when not in a critical area and 1.0 inches of runoff when the discharge is within a critical area, such as a Zone II of a public water supply well. All proposed point source discharges treating runoff from impervious surfaces are located outside critical areas and will meet the 0.5 inch treatment requirement. The following table indicates the TSS removal rates for the respective point source discharges (**See Figures 5-01, 5-02, and 5-03**):

Subcatchment 9,10,11,15,17,18:

Street sweeping (10%), deep sump hooded catch basins (25%), water quality swale (70%): 80% overall

Subcatchment 12,16,22:

Street sweeping (10%), deep sump hooded catch basins (25%), infiltration basin (80%): 86% overall

Subcatchment 13:

Street sweeping (10%), deep sump hooded catch basins (25%), Stormceptor (83%), detention basin (25%): 91% overall

Subcatchment 26:

Street sweeping (10%), deep sump hooded catch basins (25%), Stormceptor (80%), sediment forebay (25%): 90% overall

Subcatchment 27,29:

Street sweeping (10%), deep sump hooded catch basins (25%), infiltration basin (80%), detention basin (25%), Stormceptor (80%), sediment forebay (25%): 98% overall

Subcatchment 28:

Detention basin (25%), Stormceptor (80%), sediment forebay (25%): 89% overall

Subcatchment 30:

Street sweeping (10%), deep sump hooded catch basins (25%), infiltration trench (80%): 86% overall

Subcatchment 31:

Infiltration basin 80%

Subcatchment 25,32,33,34,35,36:

Additional treatment of runoff from impervious areas is provided by the infiltration of roof runoff from a number of the proposed buildings, which will have a TSS removal rate of 80%.

Standard #5 Land Uses with Higher Potential Pollutant Loads

TRQR Design Provision: This standard is not applicable to the project since no Land Uses with Higher Potential Pollutant Loads are being proposed.

Standard #6 Protection of Critical Areas

TRQR Design Provision: There are two critical areas proximate to the site:

- * A Zone A associated with Nagog Pond, where no stormwater BMPs are proposed
- * A Zone II associated with the Conant wells.

All proposed point source discharges that will treat runoff from impervious surfaces are located outside of Critical Areas.

There will be a slight widening of Skyline Drive where it intersects Great Road, resulting in an additional 310 square feet of impervious area. Runoff from this area will drain to an infiltration basin that treats 1 inch runoff from Skyline Drive and has adequate capacity for such a modest increase in impervious area. The existing discharge is within the Zone II and the requisite treatment volume is provided.

Construction of two existing stormwater basins, associated with the construction of the 18-hole golf course, that are within a Zone II of a public water supply (Basins 20 & 21, which collect runoff from Subcatchments 20 & 21) will be completed and fitted with acceptable outlet structures. These subcatchment areas contain paved cart paths that do not have structured stormwater collection systems. Runoff from the cart paths sheet flows through vegetated buffer strips. These basins were part of the QRCC permit plans and no new construction is proposed within their drainage subcatchment areas.

Standard #7 Redevelopment

This standard is not applicable to this proposal.

Standard #8 Erosion and Sedimentation Controls

A comprehensive approach to managing erosion and sedimentation is depicted on Figures 5-10, 5-11, and 5-12, Stormwater Pollution Prevention Plans. In general, erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed and disturbed soils during construction. Temporary erosion and sedimentation controls include minimizing areas of exposed soil, directing and controlling runoff, and rapidly stabilizing exposed areas. Prior to the commencement of construction, trenched siltation fences and haybales will be placed down gradient of all work areas. Stockpiled soils will be contained within siltation fence or staked haybales. Soils left exposed for extended periods will be mulched and seeded for temporary vegetative cover. Following construction, exposed areas will be permanently vegetated with appropriate ground cover.

Erosion and sedimentation control measures will be maintained throughout all phases of

 EXISTING STREET WALL
 EXISTING TRENCH (ON OR BELOW)
 EXISTING TRENCH (ABOVE)
 VOLUME BOUNDARY UTILITY AREA
 VOLUME BOUNDARY WALL AND VOLUME PLUG
 IMPERVIOUS AREA
 100' BUFFER ZONE
 PROPOSED CONTOUR
 PROPOSED WETLAND
 PROPOSED LINE OF BANK
 PROPOSED ALLUVIUM BARRIERS
 PROPOSED SALT FENCE
 STORM DRAIN INLET PROTECTION
 PROPOSED MAIN
 SOIL STORAGE AREA
 HYDRAULIC CHECK DAM
 CONSTRUCTION PHASE

 PHASE 1
 PHASE 2
 PHASE 3
 PHASE 4
 PHASE 5
 PHASE 6

PHASE 1
PHASE 2

THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

POLLUTION PREVENTION PLAN
FIGURE 5-10
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=160' **JUNE 4, 2008**

STAMSKI AND McNARY, INC.

80 HARRIS STREET
ACTON, MASS.

ENGINEERING - PLANNING - SURVEYING

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	EXISTING STEEL WALL
	EXISTING PIPE 12" OR LARGER
	EXISTING CONDUIT UTILITY LINES
	WETLAND BOUNDARY AND WETLAND FLAG
	PROPOSED AREA
	10' BUFFER ZONE
	PROPOSED CONTOUR
	EXISTING MEDIAN
	PROPOSED MEDIAN
	PROPOSED LIMIT OF WORK
	PROPOSED 5:1 FILL BANNER
	PROPOSED 5:1 FILL FORCE
	STORM DRAIN INLET PROTECTION
	STREAM BANK
	SOIL STOCKPILE AREA
	NATURAL CREEK DAM

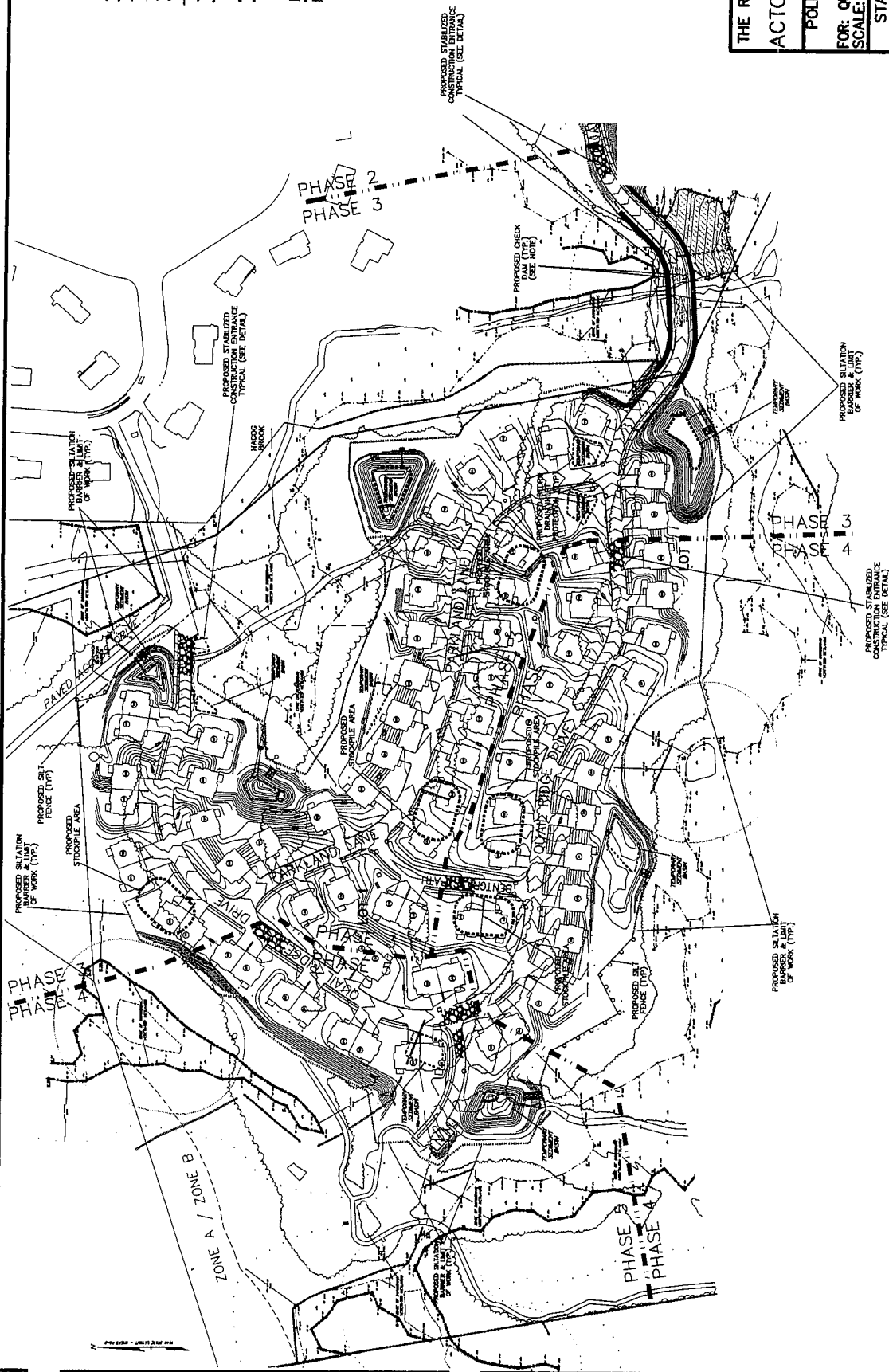
PHASE 3
PHASE 4

THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

POLLUTION PREVENTION PLAN
FIGURE 5-11
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=160' JUNE 4, 2008

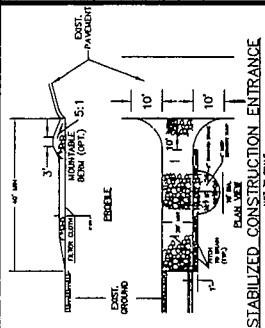
STAMSKI AND McNARY, INC.
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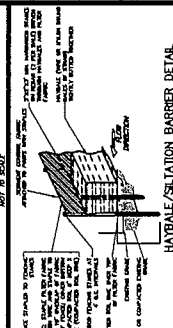


STABILIZED CONSTRUCTION ENTRANCE SPECIFICATIONS

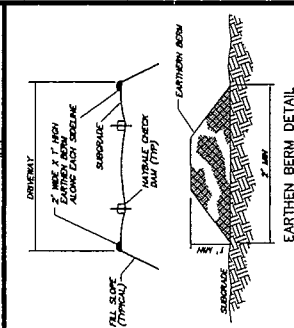
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STABILIZED CONSTRUCTION ENTRANCE



STABILIZED CONSTRUCTION ENTRANCE



STABILIZED CONSTRUCTION ENTRANCE

EROSION AND SEDIMENTATION CONTROL NOTES

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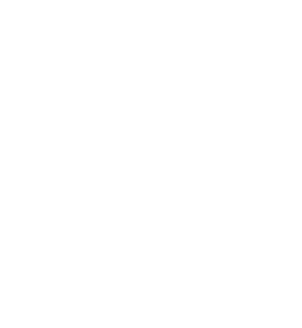
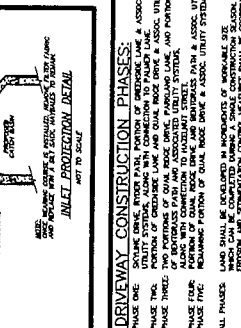
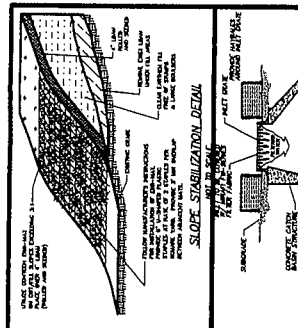
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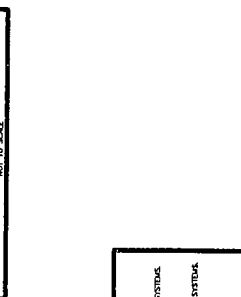
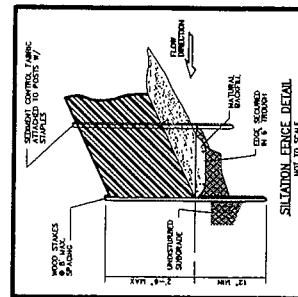
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STABILIZED CONSTRUCTION ENTRANCE



STABILIZED CONSTRUCTION ENTRANCE

THE RESIDENCES AT QUAIL RIDGE
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
POLLUTION PREVENTION PLAN
FIGURE 5-12
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=160'
JUNE 4, 2008

STAMSKI AND McNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
SH-3203B Sheet 3 of 3

construction. Inspections will be made regularly and after rainfalls exceeding 0.5 inches in a 24-hour period during construction. The contractor will be required to inspect erosion and sedimentation control measures at the end of each workday, when precipitation is forecast, and after each rainfall. All measures will be inspected prior to each weekend and the contractor will replace and repair any malfunctioning or damaged controls measures including vegetative stabilization as necessary.

Long-term erosion and sedimentation control will be realized using the BMPs described previously. Areas where soils have been disturbed will be loamed and vegetated with lawn, trees, and shrubs.

Operations and Maintenance Plan

The implementation, inspection, and repair of the erosion controls are the responsibility of the site contractor during construction. The inspection and operation of the stormwater management system upon completion of construction is the responsibility of the owner.

Site Owner:

The Residences at Quail Ridge, LLC
354b Great Road
Skyline Drive
Acton, Ma 01720
(or any future owner)

Parties responsible for long-term operation/maintenance:

The Residences at Quail Ridge, Home Owners Association
(or any future owner)

Schedule for Inspection and Maintenance:

Deep Sump and Hooded Catch Basins

The deep sump for the catch basins shall be inspected and cleaned annually each spring. The catch basins have a four foot deep sump and the water level is maintained by the discharge pipe at four feet. The discharge pipe is hidden from view by a hooded outlet.

The depth of the sediment in a basin shall not exceed a depth of 18 inches as determined by probing with a stick. If the stick hits the bottom within 30 inches of the water level, more than 18 inches of sediment has accumulated and must be removed. Licensed persons should remove and dispose of the contents of the sump in accordance with applicable regulations.

Sediment Forebay:

The sediment forebay shall be inspected after every major storm event for the first three months after construction. The sediment forebay shall be inspected twice yearly thereafter. Sediment shall be removed from the sediment forebay upon discovery of 2 inches of sediment accumulation. Eroded or barren spots shall be recovered with stone immediately after inspection to prevent erosion and accumulation of sediment. Sediment shall be removed from the forebay as needed, at least once every 10 years. This procedure shall not take place until the floor of the forebay is thoroughly dry.

Detention Basin/Infiltration Basin/Water Quality Swale:

The sediment forebay should be cleaned out once per year to the depths specified on the senior residence special permit plans by Stamski and McNary, Inc. Sediment shall be removed from the detention basin by hand once every 10 years to the depths specified on the senior residence special permit plans prepared by Stamski and McNary, Inc. For the first three years after construction, the detention basin shall be inspected during the growing and non-growing season twice per year. Data gathered during these inspections should be recorded, mapped and assessed.

- Grasses shall be inspected for survival rate. Any bare areas shall be reseeded prior to the end of the growing season.
- The detention basins shall be inspected for areas of concentrated sediment deposits. Concentrated sediment deposits shall be removed by hand.
- Side slopes of the detention basins shall be inspected for erosion. All eroded areas shall receive 6" of loam and seed according to the senior residence special permit plans by Stamski and McNary, Inc.
- The detention basins outlet structure shall be inspected for obstructions. All obstructions shall be removed upon inspection. All sediment that has accumulated in the structure shall be removed by hand.

Stormceptors:

Inspection and maintenance of the in-line *Stormceptor* can be performed from the surface, without entry into the unit, in accordance with the following schedule:

- Perform maintenance once the stored volume reaches 15% of the *Stormceptor* capacity, or immediately in the event of a spill.
- Perform quarterly inspections during the first year of installation to establish the maintenance schedule accurately.
- Remove oil and sediment through the 24-inch diameter outlet riser-pipe. Alternatively, floatables and hydrocarbons maybe removed through the 6-inch oil inspection port.
- Disposal of material removed from *Stormceptors* is similar to that of any other BMP. Consult local guidelines or your *Stormceptor* area marketing manager prior to disposing of the separator contents.

Emergency Contacts:

In the event of a hazardous materials spill on the site the following parties shall be contacted:

Fire department: ph: 978-264-9645

The Residence at Quail Ridge, LLC

Records:

The owner shall maintain an inspection log of all elements of the stormwater management plan. The owner shall also maintain a maintenance log documenting the inspection and maintenance of the drainage structures under his control. A copy of the erosion control and stormwater maintenance plan and inspection logs shall be kept on site at all times.

Standard #10 Prohibition of Illicit Discharges

TRQR Design Provision: Based on a ground survey of existing conditions, no illicit discharges to the existing stormwater management system were detected. Further, no illicit discharges are proposed in connection with the construction of the Residences at Quail Ridge.

An illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents. An Illicit Discharge Compliance Statement will be filed prior to the discharge of stormwater runoff to the post-construction stormwater best management practices.

5.3 NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT CONSISTENCY

5.3.1 General Permit for Discharges from Construction Activities

Since the project will disturb more than one (1) acre of land, it has been designed to comply with the requirements of the NPDES General Permit for Discharges from Construction Activities. A Stormwater Pollution Prevention Plan, Figures 5-10, 5-11, and 5-12, has been prepared in accordance with the General Permit Guidelines. A Notice of Intent will be filed with the EPA prior to construction.

5.3.2 Phase II Stormwater General Permit for Acton

Phase II of the NPDES program requires stormwater permitting for Municipal Separate Storm Sewer Systems (MS4s) in communities with populations under 100,000 persons and urbanized areas such as the Town of Acton. The General Permit under which Acton was eligible covers the town's MS4. The Residences at Quail Ridge will be entirely developed on private property and no connection to the MS4 is proposed, i.e. all stormwater discharges will occur on site. Notwithstanding the fact that the Phase II requirements are not directly applicable, the project has been designed to be consistent with relevant EPA and DEP standards for the six Minimum Controls Measures (MCMs) outlined by the EPA for implementation as part of the Phase II requirements. They include:

1. Public Education and Outreach

Not applicable to TRQR.

2. Public Participation/Involvement

Not applicable to TRQR.

3. Illicit Discharge Detection and Elimination

There are no illicit discharges from the site under existing conditions. Also, the Residences at Quail Ridge have been designed such that there will not be Illicit Discharges to the MS4 when the site is built.

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SECTION 6

SECTION 6 WASTEWATER

6.1 *Permitting and Application Status*

As discussed in the NPC, the Proponent submitted an application for a Groundwater Discharge permit to DEP (transmittal number W164359) on December 10, 2007 (See NPC for copy of Groundwater Discharge Permit).

6.2 *Project Overview*

The proposed Quail Ridge Wastewater Treatment Facility will be of the MBR type and is discussed in detail in section 6.3.2 below. A portion of the treated effluent will continue to be discharged to the existing Title V leaching field with a capacity of 10,000 gpd. Additional effluent will be disposed of via the proposed drip irrigation fields, with a design capacity of 50,079 gpd, located throughout the remaining 9-hole golf course. As shown in Table 6-1, the final total estimated sewage design flow for the Quail Ridge project is 57,835 gpd. Capacity of the proposed wastewater disposal system capacity, therefore, has been designed conservatively to accommodate a project total of 60,079 gpd.

6.3 *Proposed Wastewater Disposal System*

The sanitary collection system consists of 1.3 miles of low pressure sanitary sewer main and 138 privately owned grinder pump stations that will be housed inside each of the units in the single and duplex residential buildings. The three 12-unit buildings will be serviced by a single large grinder pump underground in the driveway. The restaurant and family center will be served by individual pumps as well. Figure 6-1 depicts the proposed TRQC wastewater system.

The proposed wastewater treatment facility is designed to treat an average daily flow of 60,079 gallons per day. As shown in Table 6.1, this flow will be generated by a residential development consisting of a 9-hole golf course, clubhouse and store, tennis club, swimming pool, restaurant, golf maintenance area and single and multi-family housing. The treatment facility will be operating seven days per week throughout the entire year. A portion of the effluent will continue to be discharged to the existing Title V leaching field with a capacity of 10,000 gpd. Additional effluent will be disposed of via the proposed on-site drip irrigation fields, with a design capacity of 50,079 gpd. In a drip dispersal system, effluent is discharged through small orifices into the top 18 inches of soil, typically in the B layer of soil. In this soil horizon, there is increased evapotranspiration and plant uptake of nitrogen. The advantage over typical groundwater discharge leaching areas is that drip irrigation is ideal for soils that are relatively shallow, soils that contain a loose B layer underlain with a dense glacial till C layer, and soils that are variable.

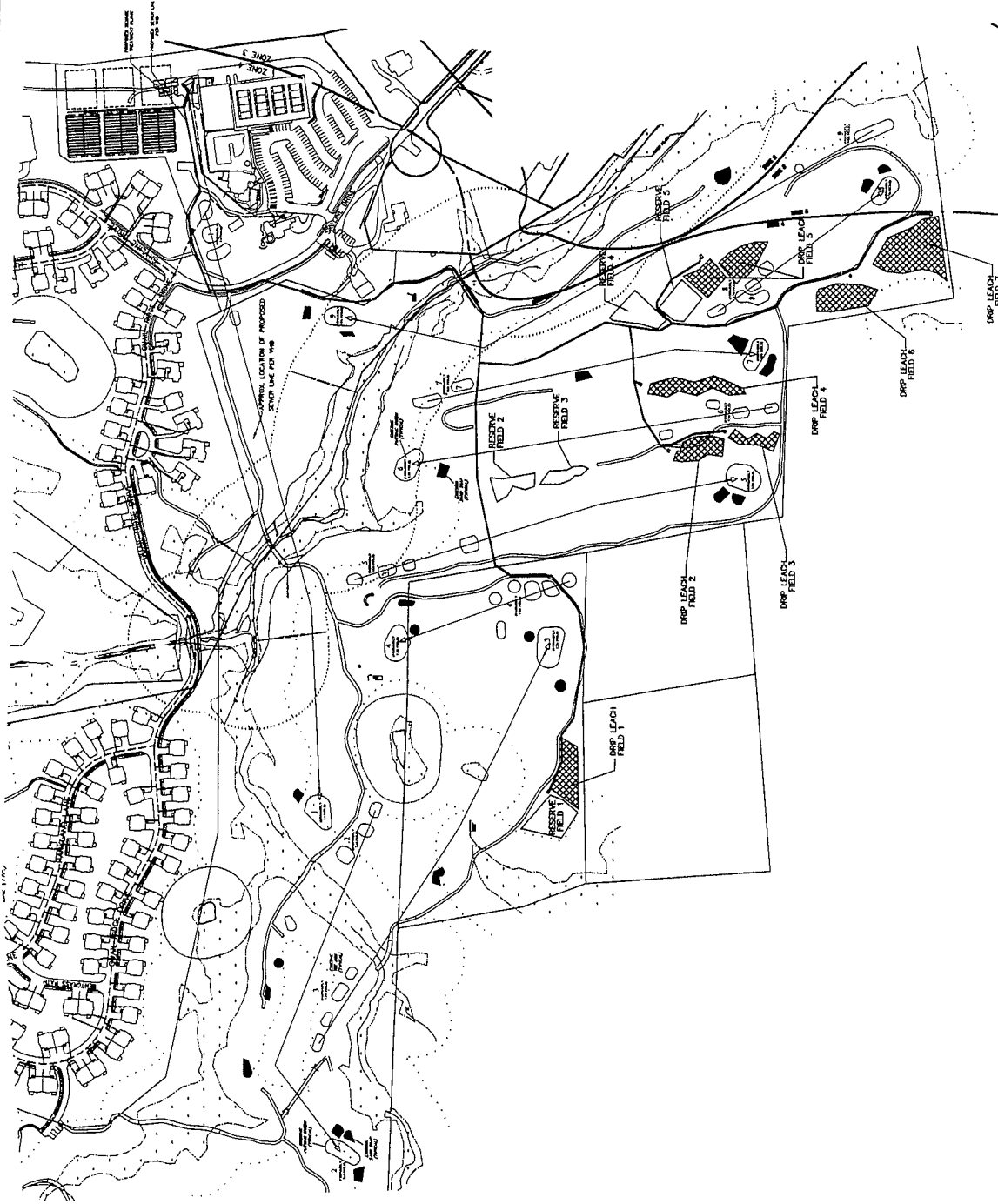
The existing Title V subsurface sewage disposal system was approved by DEP for 10,000 gallons per day and is located on the westerly edge of the property. The treatment system consists of septic tank pretreatment and the disposal system consists of a large dosing chamber with a triplex pumping system that pressure doses three leaching fields located under the driving range. The Title V loading rate used for design and permitting is 0.6 gallons per day per square foot (gpd/sf). This system will be used without any modifications and with the same

LEGEND

- EDGE OF BORDERING VEGETATIVE WETLAND
- △ WETLAND FLAG
- EDGE OF VERNAL POOL
- FLOOD PLAIN
- NAGOG BROOK / MILLS HOLE BROOK
- TOWN OF ACTON
- GROUNDWATER PROTECTION DISTRICT
- 200' RIVERFRONT AREA
- 100' BUFFER ZONE OF A VERNAL POOL

THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)
WASTEWATER TREATMENT FACILITY
FIGURE 6-1
FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200' JUNE 6, 2008

STAMSKI AND McNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING
0 25 50 100 200
(3283B WASTEWATER.dwg) SM-3283B



loading rate as permitted under Title V, however, the effluent discharged to the leaching fields will be treated in the wastewater treatment facility prior to discharge.

6.3.1 Design Flow Calculations

Table 6-1 illustrates updated estimated wastewater design flows for the Quail Ridge project incorporating final age-restricted residential unit numbers of 86 single-family, three (3) bedroom units; 26 duplex style, 3 bedroom units (total of 52 units), and three (3) 12-unit, 2 bedroom condominium units. As shown on Table 6-1, the total number of units is 174 with a total of 486 bedrooms.

The estimated design flow is based on anticipated wastewater generation using Massachusetts State Environmental Code (Title V) at 301 CMR 15.203 and Sewerage Flow estimates at 314 CMR 7.15. These references list typical generation values for the sources listed in Table 6-1. The project will have average daily wastewater flow of approximately 57,835 gpd.

Table 6-1 QRCC Estimated Wastewater Design Flows (gpd)

Wastewater Design Flows						
<u>Use</u>	<u>Unit</u>	<u>Use #</u>	<u># Units/Use</u>	<u>Total Units</u>	<u>GPD/Unit</u>	<u>Design Flow (GPD)</u>
86 Single Family - 3 BRs	BR	86	3	258	110	28,380
26 Duplex Style - 3 BRs	BR	52	3	156	110	17,160
3, 12-Unit Buildings - 2 BRs	BR	36	2	72	110	7,920
Subtotals		174 units		486 bedrooms		53,460
Tennis Club	Court			4	250	1,000
Restaurant	Seat			54	35	1,890
Swimming Pool	Person			30	10	300
Clubhouse	Locker			42	20	840
Club Office	1,000 SF			1,200	75	90
Maintenance Facility	Person			12	15	180
Retail	1,000 SF			1500	50	75
Subtotals						4,375
Total						57,835

6.3.2 Drip Irrigation System

The proposed Quail Ridge Wastewater Treatment Facility will be of the membrane bioreactor (MBR) type. The MBR process enhances and simplifies conventional activated sludge processes. The membrane barrier ensures stable operation consistently producing a high effluent quality. The system is designed to accomplish BOD and TSS removal, nitrification and denitrification. The system consists of separate settling, equalization and aeration tanks

followed by a membrane bioreactor. Aeration, mixing and pumping, as well as the MBR process, is controlled by a PLC based control system. The system will feature:

- Dual membrane filtration each with dedicated pumps capable of handling equalized average daily flow.
- Dual anoxic and aerobic bioreactors.
- Primary and standby permeate, clearwell discharge, and effluent dosing pumps.
- Ultra-violet disinfection.
- Emergency standby generator.

The required effluent discharge limits, established with DEP on 11/16/07, are:

- BOD5 – 10mg/l
- TSS – 10mg/l
- Total Nitrogen – 10 mg/l
- Bacterial – CC 200/100ml
- Potential to provide 0.5 mg/l of phosphorus (add ferric Chloride)

Three chemicals required in the treatment processes will be stored in corrosion-proof containers in the process building. Sodium hydroxide for pH control, sodium hypochlorite required in membrane cleaning and sucrose required as carbon addition to the anoxic reactor. Minor cleaning agents used for general purpose cleaning will be stored in the process building. The new effluent disposal system located throughout the 9-hole golf course will utilize drip dispersal technology spread over seven different areas in which effluent is pumped through an extensive network of small diameter perforated pipes. Figure 6-1, Wastewater Treatment Facility, depicts the location of the drip disposal fields and related wastewater infrastructure.

The dripfields are designated as follows:

- Dripfield 1 – 5,940 GPD
- Dripfield 2 – 4,755 GPD
- Dripfield 3 – 2,589 GPD
- Dripfield 4 – 5,828 GPD
- Dripfield 5 – 9,480 GPD
- Dripfield 6 – 7,072 GPD
- Dripfield 7 – 14,416 GPD

Total – 50,079 GPD

The drip dispersal system to be used at Quail Ridge is patented and manufactured by Geoflow, Inc. (Design, Installation and Maintenance Guidelines included). The main advantages of Geoflow's subsurface drip system for effluent dispersal are:

- Human and animal contact with effluent is minimized, reducing health risk.
- Correctly designed systems will not cause puddling or runoff.
- It can be used under difficult circumstances of high water tables, tight soils, rocky terrain, steep slopes, around buildings, trees or other vegetation, and on windy sites.
- Disposal of water is maximized by means of evapotranspiration.
- The system requires no gravel. It is easy to install directly into indigenous soils and

the natural landscape can be maintained.

- Minimizes deep percolation.
- Consumption of nitrates by the plant material is increased.
- Invisible and vandal proof installations.
- Fifteen-year warranty for root intrusion, workmanship, and materials. Systems are durable with a long expected life of approximately 30 years.
- Non-intrusive. It allows use of the space while operating.
- Easily automated.

6.4 Groundwater Discharge in Freezing Climates

Geoflow systems can be used year round in all climates. The drip line self drains through the emitters every time the system stops flowing and does not hold water. Sound design, including drainback of the system, air vacuum breakers and insulation of the more rigid parts of the system keep the system working even in the coldest climates. Appendix B contains a report by that provides an in-depth review of the design and performance of drip dispersal systems in freezing environments.

6.5 Sewage Disposal Mitigation

Test pits have been excavated and percolation rates have been observed by DEP. Testing has confirmed adequate sites for drip irrigation fields for up to 60,079 gpd (See Figure 6-1, Wastewater Treatment Facility). The Proponent has proposed the installation of monitoring wells up gradient and down gradient at each drip irrigation field. In order to minimize sewage disposal, the final design of the wastewater disposal system will meet or exceed all applicable code requirements for low flow fixtures.

SECTION 7

SECTION 7 WATER

7.1 Irrigation Water: Permitting and Application History

The FEIR stipulated that the Proponent apply for a Water Management Permit. In 2002, an application was filed with DEP. In lieu of a Water Withdrawal Permit, DEP and QRCC entered into an Administrative Consent Order (ACO) in 2003 for irrigation of an 18-hole golf course.

7.1.1 DEP 2003 Administrative Consent Order

The ACO outlined a stringent set of reporting guidelines including daily water withdrawals and a well monitoring program. The ACO limited QRCC water withdrawals to 100,000 gpd and 900,000 gallons in any 3-month period and included two withdrawal wells and an irrigation pond. Monitoring included water level, water quality, and stream flows. All mitigation measures outlined in the FEIR were mandated by the 2003 ACO except for the Turfgrass and IPM program, which is reported yearly to the Town of Acton.

There is one primary irrigation well that supplies the irrigation pond, and a second irrigation well that is only used as an emergency back-up. Other wells are on site and for monitoring only. QRCC augments its state-of-the-art sprinkler system using a 9 million gallon irrigation pond (7 million usable) to decrease any potential stress on ground water levels during the summer months when New England experiences reductions in rainfall. The clay lined retention pond broke out on two occasions in 2006, resulting in a severe loss of stored water. Because of those breaks, the water withdrawals exceeded permitted amounts allowed.

As a result of the 2006 water withdrawal exceedance, use of the irrigation system is guided by the 2007 ACO. A stipulation of the 2007 ACO is that a Water Management Permit be filed for action by DEP. The WMA permit was filed on August 6, 2007, transmittal #W149295. The 2007 ACO allows 99,000 gpd, confirming and updating reporting requirements including:

- the four capped wells: BE-1, BE-2, BE-3 and BE-6 are used to monitor ground water levels only;
- BE-7 (primary) and BE-5 (emergency backup) irrigation wells, the irrigation pond and Acton Water District withdrawals (if any) are reported daily, monthly and quarterly to DEP;
- ground water levels are measured each month from monitoring wells BE-1, BE-2, BE-3 and BE-6 and wetland piezometers at location WL-1 through WL-4, tabulated and graphed (water level elevation versus time) and submitted to DEP each quarter;
- stream flow and temperature are monitored at both up gradient and down gradient locations on Nagog Brook at QRCC providing to DEP a graphical representation of the tabulations on the 15th of February each year.

The existing irrigation system on TRQR will be eliminated. Water for a lawn sprinkler system for TRQR will be supplied by the AWD, and the Condominium will follow all summer outside AWD water conservation measures.

7.1.2 Status

QRCC will operate through the end of the 2008 season. The maximum daily usage set by the 2007 ACO was 99,000 gpd, a level that was not exceeded in 2007 or 2008. Future operation of the facility as a 9-hole golf course will see a reduction in water usage by roughly 40% or approximately 39,500 gpd.

7.2 Potable Water

7.2.1 Source

According to the Acton Water District, the total annual withdrawal allowed for the town of Acton in 2008 is 706,640,000 gallons, with an average daily withdrawal of 1,936,000 gpd. For 2009, the limits are 707,370,000 gallons annually, with an average daily withdrawal of 1,938,000 gpd.

If TRQR were to be built out entirely in 2009, the average day demand on the District's system would account for 2.98% of its allowed withdrawal. The maximum day demand, including irrigation, would account for 4.98% of its allowed withdrawal. It should be noted that the estimates for water usage have been based on Title V flow requirements for calculating wastewater volume, which are very conservative. We expect actual usage to be significantly lower. Also, it should be considered that the District's allowed withdrawal tends to increase from year to year, and, since the build-out of TRQR will most likely be phased over 5-7 years, the impact of the project on the District's allowable withdrawal at build-out will be lower than calculated based on 2009 limits.

AWD Rules and Regulations requirement #28 states that a project with a "design demand greater than 2,500 gpd, or a service line over 2 inches in diameter must provide a Water Impact Report to the AWD for approval by the Board of Water Commissioners." The Water Impact Report must include: 1.) the expected impact of the project on the District's existing supply system, including maintenance of adequate fire flows and impact of the project on the District's Water Management Act Withdrawal permit compliance and; 2.) conditions and water conservation measures that will mitigate the effect of the projects impacts. Flow tests were completed and the Proponent filed a Water Impact Report with the AWD in June of 2008. Additionally, testing for maintenance of adequate fire flows was conducted recently at the proposed points of connection to the District's existing system, at Skyline Drive, Palmer Lane and Hazelnut Street. The results of this testing were forwarded to the AWD from the fire sprinkler designer, Dynamic Fire Protection, Inc.

Estimated Demand:

The project will be constructed in 2 phases beginning in 2009, and it is estimated that the total build-out may take 5-7 years to complete, depending on market conditions. Construction of the housing in each phase will be timed to keep pace with the market.

Phase 1 will include the construction of the 3 multi-family buildings, 12 duplex style buildings and 37 single-family buildings, totaling ninety-seven (97) units. In addition, the existing facilities at Quail Ridge Country Club will be available for use. Infrastructure in Phase 1 will consist of

the reconfiguration of Skyline Drive at Great Road, connection to Palmer Lane, Greenside Lane, Ryder Path and Quail Ridge Drive from Skyline Drive to the wetland crossing at Nagog Brook.

Phase 2 will include the construction of 14 duplex style buildings and the remaining 49 single-family buildings. It is expected that the proposed restaurant will also be constructed in this phase. Infrastructure in Phase 2 will include the wetland crossing at Nagog Brook, Quail Ridge Drive to Hazelnut Street, Parkland Lane and Bentgrass Path. Water mains will be looped, with proposed connections at Skyline Drive, Palmer Lane and Hazelnut Street.

Based on Title V requirements for wastewater design flows (as shown in Table 6-1), potable water usage is estimated as follows:

Table 6-1

<u>Wasterwater Design Flows</u>						
<u>Use</u>	<u>Unit</u>	<u>Use #</u>	<u># Units/Use</u>	<u>Total Units</u>	<u>GPD/Unit</u>	<u>Design Flow (GPD)</u>
86 Single Family - 3 BRs	BR	86	3	258	110	28,380
26 Duplex Style - 3 BRs	BR	52	3	156	110	17,160
3, 12-Unit Buildings - 2 BRs	BR	36	2	72	110	7,920
Subtotals		174 units		486 bedrooms		53,460
Tennis Club	Court			4	250	1,000
Restaurant	Seat			54	35	1,890
Swimming Pool	Person			30	10	300
Clubhouse	Locker			42	20	840
Club Office	1,000 SF			1,200	75	90
Maintenance Facility	Person			12	15	180
Retail	1,000 SF			1500	50	75
Subtotals						4,375
Total						57,835

In order to attain estimated maximum day water demand, we calculated irrigation requirements as follows:

$$11.16 \text{ acres} \times 1" \text{ per/week for 3 months/90 days} = 38,794 \text{ gpd}$$

$$\text{Total Maximum Day Water Usage (Including Irrigation)} = 96,629 \text{ gpd}$$

Again, it should be noted that Title V wastewater estimates are typically conservative when used for water estimates in that they overestimate the flows generated from various uses. Actual meter readings can show water usage to be 45%- 50% less than wastewater design flows would indicate. TRQR is an age-restricted community, and despite the bedroom count of the

proposed units, it is anticipated that a majority of the homes will be occupied by only 2-3 persons.

Water Conservation Efforts:

Outdoor conservation measures incorporated into TRQR include minimizing the areas to be irrigated to an average of 2,800 SF per unit, use of 6" or more of topsoil in landscape & turf areas, and the use of a pool cover at the Family Center Complex. In addition to the development of housing, a significant portion of the existing golf course, which is currently irrigated, will become open space for active and passive recreation, and allowed to revert to natural conditions. Turf and plantings at TRQR will be drought resistant.

Indoor conservation measures will include the use of ultra-low flow toilets, low flow aerators on faucets and showerheads with flows restricted 2.5 gpm in our standard specifications. Although we do not typically provide washing machines as part of the standard appliance package, we will encourage home buyers to select horizontal axis units.

SECTION 8

SECTION 8 CONSTRUCTION & PROJECT PHASING

Section 8 responds to questions raised in the Secretary's Certificate on the NPC. The Certificate requests that construction impacts and measures to limit those impacts be analyzed.

8.1 Overview

The DEIR Certificate required that the FEIR present a construction schedule and an analysis of construction impacts and feasible measures to mitigate those impacts.

8.2 Proposed Construction Schedule

The project will be constructed in 2 phases beginning in 2009, and it is estimated that the total build-out may take 5-7 years to complete, depending on market conditions. Construction of the housing in each phase will be timed to keep pace with the market.

Phase 1 will include the construction of the 3 multi family buildings, 12 duplex style buildings and 37 single family buildings, totaling ninety seven (97) units. In addition, the existing facilities at QRCC will be available for use. Infrastructure in Phase 1 will consist of the reconfiguration of Skyline Drive at Great Road, connection to Palmer Lane, Greenside Lane, Ryder Path and Quail Ridge Drive from Skyline Drive to the wetland crossing at Nagog Brook.

Phase 2 will include the construction of 14 duplex style buildings and the remaining 49 single-family buildings. It is expected that the proposed restaurant will also be constructed in this phase. Infrastructure in Phase 2 will include the wetland crossing at Nagog Brook, Quail Ridge Drive to Hazelnut Street, Parkland Lane and Bentgrass Path.

8.3 Potential Impacts

8.3.1 Noise

Increased noise is an unavoidable result of construction activities. The Proponent intends to continue implementing all measures as outlined in the FEIR to minimize noise impacts from construction activities. Measures will include :

- Using appropriate mufflers on all equipment and maintaining intake and exhaust mufflers;
- Muffling enclosures for continuously running equipment such as air compressors;
- Turning off idling equipment;
- Limiting construction activity to 7:00 a.m. – 5:00 p.m. weekdays, 8:00 a.m. – 2:00 p.m. on Saturdays, and no work on Sundays.
- Shielding noisy equipment from sensitive areas by physical barriers or distance, and;
- Complying with DEP and Town of Acton noise ordinances where applicable.

8.3.2 Dust Control

Dust is an unavoidable result of earth removal and construction activities. Contractors will be required to minimize dust by using dust control measures including:

- Moistening exposed soil;
- Covering trucks transporting materials emitting dust;
- Washing down trucks in a designated area to prevent dust and dirt from being deposited on local roads, and;
- Placing crushed stone sediment traps on temporary construction roads to prevent sediment from being carried onto main roads.

8.3.3 Wetlands: Erosion and Sedimentation Control

Incorporating BMPs in guidelines established by both the DEP and the United States Environmental Protection Agency (EPA), an erosion and sediment control program will be instituted to minimize impacts during construction to wetland resource areas. The NPC construction will comply with the NPDES General Permit for Stormwater Discharges from Construction Activities. A SWPPP along with an NOI will be filed with the EPA. The SWPPP will be on site and centrally located for use and review by all operators and contractors/managers named in the SWPPP with oversight responsibilities. See Section 4 for further details.

Figures 5-10, 5-11, and 5-12, Pollution Prevention Plan, depict proposed erosion and sedimentation control measures with construction notes.

- Erosion and sediment control measures shall be implemented prior to any construction on the site.
- Hay bales and silt fence shall be placed in all areas as shown on all the plans and in any other areas as determined necessary during construction.
- All soil stockpiles shall have erosion control measures around their edges at all times.
- The drainage system shall be constructed early in the project in order to direct runoff and sediment to temporary sediment basins.
- All catch basins shall be covered with siltation fabric during construction. Catch basin rims are to be set at binder grade until it is time to apply the pavement wearing course.
- All cut and fill slopes shall be immediately covered with 4" of loam and seeded during the growing season (April 1 to November 1) or covered with hay mulch during the non-growing season (November 1 to April 1). In areas subject to the Wetlands Protection Act, the hay mulch and/or required measures remain in place until permanent vegetation is reestablished.
- Unless otherwise indicated, all disturbed areas shall receive 4" of loam and be seeded to prevent erosion.
- All catch basin sumps shall be cleaned following construction.
- Upon accumulation of 6" of sediment, the temporary sediment basins shall be cleaned.
- The hay bales and silt fence shall be maintained until vegetative cover has been suitably established, graded slopes are stable, and a Certificate of Compliance has been issued from the ACC.
- All slopes steeper than 3:1 shall be covered with erosion control fabric.

Hay bales will be used around the catch basins on the proposed street to protect them from the eroding soils and provide a check dam to slow the runoff during the construction. The Proponent will provide velocity check dams in all unpaved street areas at the intervals indicated below:

Grade of the Driveway	Interval between Check dams
Less than 4%	100 Feet
4% to 10%	50 Feet
Over 10%	25 Feet

Erosion/sedimentation control measures shall remain in place for all construction activities.

8.3.4 Inspection and Maintenance

The Proponent is responsible for cleaning up any sediment or debris that erodes from the site into the wetlands immediately upon discovery. The Proponent is also responsible to clean up sediment or debris that erodes from the site onto streets or private property and to remove sediment or debris that enters any existing drainage system including catch basin sumps, pipelines, manholes, and ditches.

The contractor will follow standard practice and loam and seed all disturbed areas following construction. A maintenance and operation plan shall be placed at all times on the site. Operator personal must inspect the construction site at least every seven days and within twenty-four hours of a rainfall of 0.5 inches or more. Disturbed areas that have been stabilized must be inspected at least once per month.

The siltation controls shall remain in place until a vegetative cover has been established. All catch basin sumps and manholes shall be cleaned out after construction. The Proponent shall adhere to any previous conditions, which may still be in effect relative to the portion of the existing golf course that is to remain.

8.3.5 Blasting

The Proponent will continue to avoid blasting wherever possible.

8.3.5.1 Blasting Requirements

Necessary permits, pre-blast surveys, and informational meetings will be coordinated and scheduled at the direction of the Acton Fire Department and/or other Town of Acton officials. Additionally, where blasting is necessary, advance notice will be made to the Town of Acton, the Town of Concord, and abutters.

8.3.5.2 Limitations on the use of Perchlorate

Perchlorate will not be used as a blasting agent at the site.

8.3.6 Construction Traffic Management Routes

All construction traffic will access the site via Great Road and Skyline Drive. Based on the cut and fill figures below, there will be a total number of 575 truck trips over the 5-7 year build-out schedule.

8.3.6.1 Estimated Truck Trips

Based on an individual truck size of 30 yards, there will be approximately 575 truck trips leaving the project site with material over the 5-7 construction year period.

8.3.7 Cut and Fill Calculations

The following Cut and Fill estimates were calculated by Stamski and McNary, Inc. dated 6/5/08. Areas of cut and fill are shown on Figure 8-1, Cut and Fill Areas.

Plan Reference: *The Residence at Quail Ridge Site Development Plan* by Stamski and McNary, Inc. dated 6/06/08.

Table 8-1: Site Volume: Unadjusted

Cut Yards	Fill Yards	Net	Method
94978	97832	2854 (F)	Composite
91108	93939	2831 (F)	Grid

Avg. fill = $(2854 + 2831) / 2 = 2,843$ c.y. fill

Cut Adjustment: Due to Construction Materials

Proposed Buildings:

Volume of the proposed buildings with garages, and proposed Lot 2 improvements to the golf course were calculated by Auto-CAD and are reflected in the table above.

Pavement (Road Only):

Average depth of pavement with associated gravel is 21.5".

Total paved area: 225,602 s.f.

$225,602 \text{ s.f.} \times 21.5" \times (1 \text{ ft./}12") \times (1 \text{ c.y./}27 \text{ c.f.}) = 14,970 \text{ c.y. of mat'l removed as cut.}$

Driveway:

Average depth of pavement with associated gravel is 15".

Total paved area: 79,325 s.f.

$79,325 \text{ s.f.} \times 15" \times (1 \text{ ft./}12") \times (1 \text{ c.y./}27 \text{ c.f.}) = 3,672 \text{ c.y. of mat'l removed as cut.}$

Sidewalk:

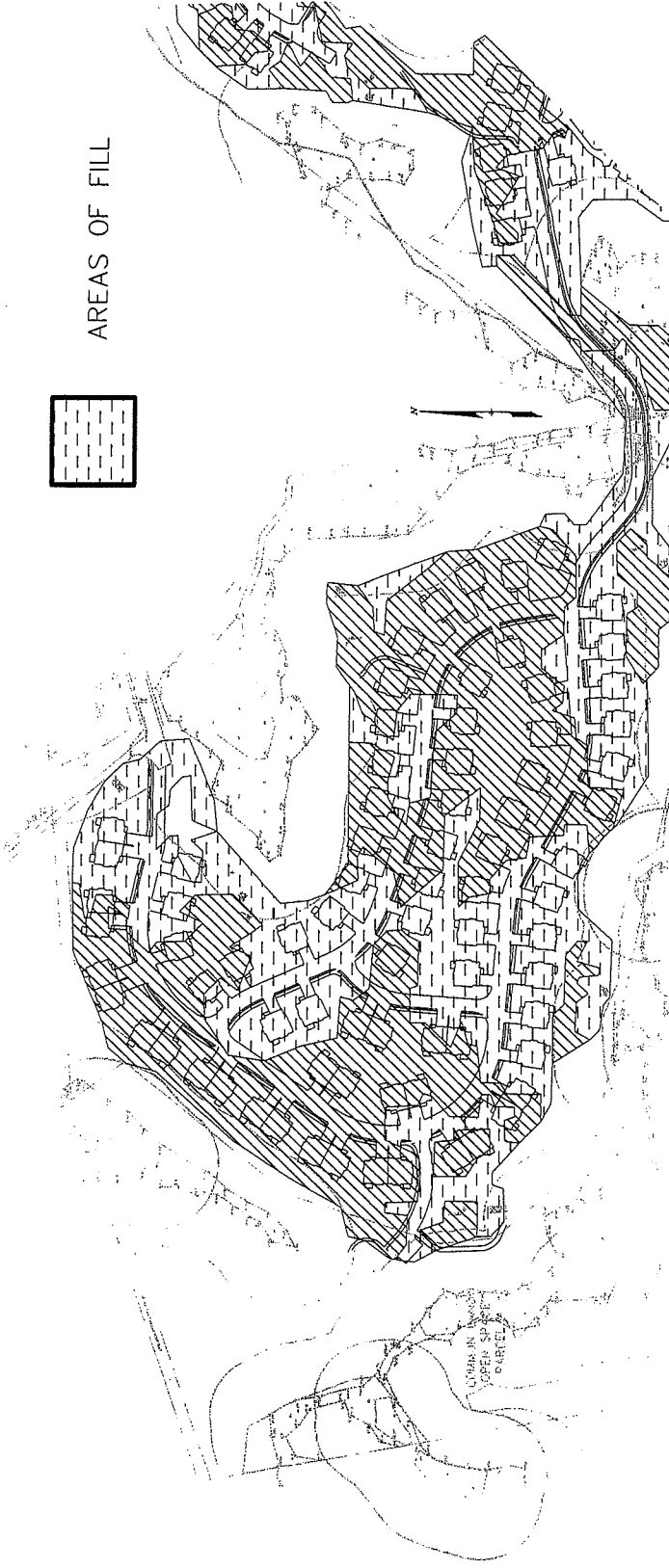
Average depth of concrete pavement with associated gravel is 11.5".



AREAS OF CUT



AREAS OF FILL



THE RESIDENCES AT QUAIL RIDGE
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

CUT AND FILL AREAS
FIGURE 8-1

FOR: QUAIL RIDGE COUNTRY CLUB, LLC
SCALE: 1"=200' JUNE 6, 2008

STAMSKI AND MCNARY, INC.
80 HARRIS STREET
ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING

0 125 250 500
(3083B cut, fill) SA-3083B Sheet 1 of 2

Total Sidewalk area: 41,145 s.f.

$41,145.5 \text{ s.f.} \times 11.5" \times (1 \text{ ft.} / 12") \times (1 \text{ c.y.} / 27 \text{ c.f.}) = 1,460 \text{ c.y. of mat'l removed as cut.}$

Final Adjustment:

-2,843 c.y. + 14,970 c.y. + 3,672 c.y. + 1,460 c.y. = 17,259 c.y. cut

METHODOLOGY

Cut and Fill Calculations:

The cut and fill calculations were performed with the use of Autocad Release 2000i, Civil Design2i module. The existing contours were used as the base elevations, and the proposed contours for the site were overlaid. Two methods were used to calculate the cut and fill volumes: grid and composite. The average value for these calculations was used. The average cut value was adjusted for the cut necessary for pavement and sidewalk installation.

SECTION 9

SECTION 9 ARCHEOLOGICAL RESOURCES

9.1 Site Inspection Survey

At the recommendation of both the MHC and the Secretary's Certificate on the DEIR, QRCC contracted PAL, Inc., of Pawtucket, RI, to conduct an intensive archeological survey of the site. Under Research Permit #2099, PAL, Inc., completed an intensive survey and technical report on the QRCC site and submitted the survey and report to MHC.

PAL, Inc., determined that the homestead and quarry locales were "cultural resources" reflecting Acton's past and "the cottage industries in which the local inhabitants involved themselves". It was recommended that the homestead be avoided and that the quarry locales, to the greatest extent possible, be incorporated into the design of the golf course. The Proponent was encouraged to meet with MHC to determine if any of the existing quarry locations might be incorporated into the design of the golf course.

As a result of this survey, QRCC agreed to incorporate to the greatest extent possible existing quarry locales into the design of the golf course and to salvage quarry stones bearing the markings and drill holes from the former quarry operation from those locales that would be disturbed.

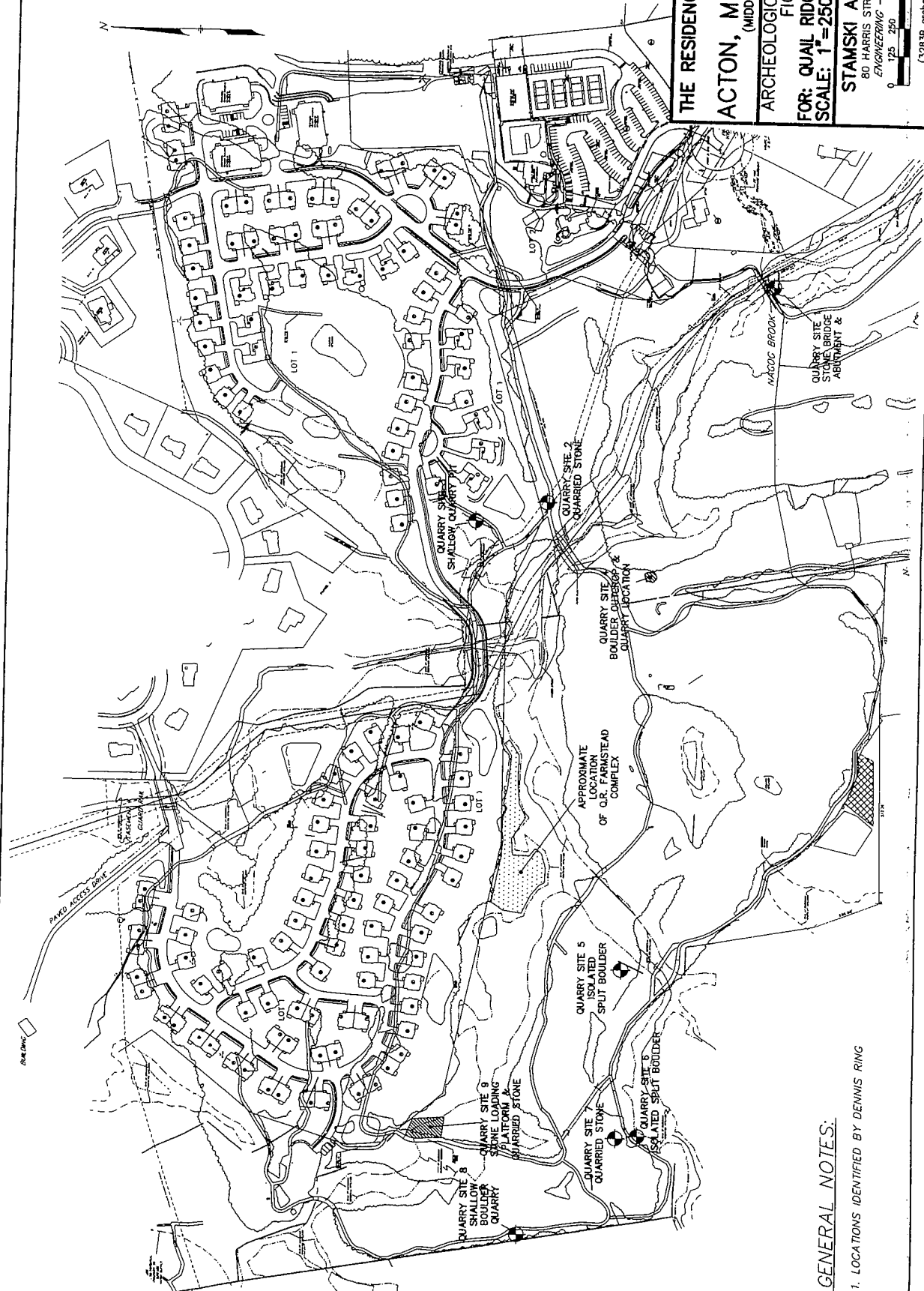
9.1.1 Current Condition

10 sites identified by Pal, Inc. are intact. All of the sites and homestead ruins are located on the southern portion of the parcel and spread over the front nine (9) holes of the golf course (See Figure 9-1, Archeological Features Plan). Each of the ten (10) sites display past quarry operations while the homestead ruins are of a late 18th century subsistence farm (See Figure 9-1, Archeological Features Plan Picture, and Site picture Sets 1-10 contained in Appendix C). Salvaged quarry stones are used throughout the course as tee markers and landscape features. The following signage has been ordered and will be delivered and installed in July 2008:

1. An 8x10 commemorative brass plaque to be installed on the first tee marker reading: "**Granite tee markers are cottage industry artifacts from the late 18th- early 19th centuries. Preserved sites where Acton farmers quarried granite can be viewed off holes 1,3, 8, 11, 14 & 17.**"
2. Nine (9) 7x5 vinyl signs to be installed at the locations noted on Figure 9-1 reading: "**Preserved Quarry Site.**"

9.1.2 Future Condition

All remaining quarry operation locations and the homestead will remain undisturbed. All the salvaged quarry stones presently used on the northern portion of the golf course as tee markers and landscape features as pictured in the NPC will be relocated on TRQR and reused for trailheads, street signs, numbering, and landscape features.



THE RESIDENCES AT QUAIL RIDGE
 IN
 ACTON, MASSACHUSETTS
 (MIDDLESEX COUNTY)
 ARCHEOLOGICAL FEATURES PLAN
 FIGURE 9-1
 FOR: QUAIL RIDGE COUNTRY CLUB, LLC
 SCALE: 1"=250'
 JUNE 6, 2008
 STAMSKI AND McNARY, INC.
 80 HARRIS STREET ACTON, MASS.
 ENGINEERING - PLANNING - SURVEYING
 0 125 250 500 1000
 (32838 archeol.dwg) SW-32838

GENERAL NOTES:

1. LOCATIONS IDENTIFIED BY DENNIS RING

SECTION 10

SECTION 10 SUSTAINABLE DESIGN

10.1 OVERVIEW OF SUSTAINABLE DESIGN INITIATIVES

In 2000, the TRQR proponent was named Energy Star™ Builder of the year. Since then the proponent has maintained a philosophy of building responsibly to help preserve the environment. TRQR will adhere to the guidelines of green building from the perspectives of the site and infrastructure, building materials and construction methods, as well as energy and water reduction. In addition, the marketing and sales programs for TRQR will provide on-going education to residents and prospective buyers about evolving green building and green living guidelines, methods, and practices.

10.2 SUSTAINABLE DESIGN ELEMENTS, MANAGEMENT APPROACH, & CONSTRUCTION PRACTICES

TRQR green building and living guidelines, methods, and practices are summarized in sections 10.2.1 through 10.2.3., below.

10.2.1 SITE CHARACTERISTICS and DEVELOPMENT APPROACH

The approximately 155-acre site was developed originally as a private 18-hole golf course and country club (QRCC). As a redevelopment project, the proposed 174-unit, over-55 age restricted, cluster subdivision (including nine (9) affordable housing units that will qualify toward Town Affordable Housing Stock) and nine (9) hole golf course will result in significantly lower density than the approximately 446 units eligible for approval under current Town of Acton Zoning Bylaws.

As a cluster subdivision, the 174 units and associated infrastructure are concentrated on approximately 40 acres allowing environmentally sensitive areas and farmland to remain undisturbed. Approximately 115 acres, or 75% of the site, is preserved as open space for passive recreation, including a parking area for public access (walks & trails) to Town conservation and semi-private access to Dog Park, 9-hole Golf Course & Cross Country Ski Trails.

The development serves as an example of contemporary "smart-growth" philosophy, offering reduced commuting and easy access to Town facilities. Approximately 25-miles northwest of Boston with direct access to Routes 2A, 27, 119, and 110, TRQR is located within approximately 3.5 miles of the MBTA South Acton Commuter station and in close proximity to major interstates 495 & 95. Located just to the north of the Routes 2A/119 and 27 intersection, the site also has the advantage of pedestrian-oriented access to nearby businesses, retail shops, and recreational fields.

10.2.2 INFRASTRUCTURE

As a cluster development, TRQR infrastructure was minimized to the maximum possible extent, reducing the disturbance of environmentally sensitive areas as compared to conventional, large-lot subdivisions. Private roadways were designed to the minimum pavement widths allowed by the APB in order to minimize disturbance and impervious area. An on-site wastewater treatment facility was designed to accommodate development needs and, on the average, will provide approximately 60,000 gpd of groundwater recharge. Finally, as discussed in detail in Section 5, the comprehensive, integrated stormwater management system and erosion control plans have been designed to meet DEP and EPA stormwater and water quality standards and requirements.

10.2.3 CONSTRUCTION

State of the art building materials and methods will be used on the construction of all units to achieve green building and living goals.

10.2.3.1 Materials:

1. Energy Star™ rated high efficiency materials & systems to facilitate or exceed requirements for Energy Star™ Certification will be utilized in all unit construction, including:

- Insulation & Air Infiltration:

Units will be insulated with cellulous (blown-in with vapor barrier) made from recycled newspaper. This insulation is fire retardant, more moisture resistant than fiberglass insulation, 38% tighter, and requires 26% less energy.

- Windows:

All unit windows will feature advanced technologies such as invisible glass coatings, vacuum-sealed spaces filled with inert gas between the panes, improved framing materials, better weather stripping, and warm edge spacers, all of which reduce heat gain and loss. Compared to less efficient windows, Energy Star™ qualified windows help keep homes warmer in the winter and cooler in the summer, blocking 70 percent or more of the solar heat gain in the summer and reflect radiant heat indoors during winter.

- Duct Tightness:

Ducts (the air distribution system) carry air from the central heater or air conditioner to each part of the home and back again. In a typical house, about 20 percent of the air that moves through the duct system is lost due to leaks, holes, and poorly connected ducts. The duct systems found in all units will be third-party tested for tightness and verified to be properly insulated.

- Heating & Cooling Systems:

All units will be equipped with Energy Star™ qualified gas furnaces having annual fuel utilization efficiency (AFUE) ratings of 83 percent or higher. These furnaces are 15 percent more efficient than standard models.

Gas water heaters, which save more energy than electric, will be used in all units.

All units will be equipped with Energy Star™ central air conditioners. These air conditioners have a higher Seasonal Energy Efficiency Ratio (SEER) than standard models (the higher the SEER, the greater the efficiency). Energy Star™ qualified central air conditioners are approximately 8 percent more energy efficient than minimum standard equipment.

- **Lighting:**

An Energy Star™ Advanced Lighting Package (APL) will be designed and offered to all homeowners as a standard construction specification. In addition, where applicable, Energy Star™ qualified compact fluorescent light (CFL) bulbs will be installed. These bulbs use about 75 percent less energy than a comparable standard incandescent bulb and replacing a 60-watt incandescent with a 13-watt CFL can save more than \$30 in energy costs over the life of the bulb.

- **Appliances:**

An Energy Star™ certified appliance package will be designed and offered to all homeowners as a standard construction specification. These appliances incorporate advanced technologies, use 10 to 50 percent less energy than standard appliances, save money, and reduce both water usage and emissions of greenhouse gases & air pollutants at the source.

- **Water Conserving Plumbing Fixtures:**

A Kohler™ water saving plumbing fixture package will be designed and offered to all homeowners as a standard construction specification. Packages include features such as aerated faucets (saving hundreds of gallons per month), high efficiency toilets (saving up to 2,200 gallons of water annually), and 1.75 gpm showerheads (saving up to 7,500 gallons of water annually).

10.2.3.1 Methods:

The construction of all units will employ "Material Efficient Framing" resulting in no more than 10% waste. To minimize further construction waste, all laborers will be provided with Green Building Awareness Training and waste material will be collected in construction waste recycling bins. A comprehensive, drought-tolerant landscaping plan will be developed for the exterior space of the residential units. The plan design will emphasize limited areas of turf and include a non-toxic/organic integrated pest management plan. When completed, units will be subject to Third Party Energy Star™ Inspections for certification. Finally, each unit owner will be provided with recycling bins for refuse collection and appropriate manuals and articles promoting green building and green living.

10.3 MANAGEMENT OF EXTERIOR SPACES

10.3.1 Low Impact Turf Management Program and Integrated Pest Management Programs

As discussed in Section 11, Mitigation/ Section 61 Findings and Commitments, the proponent remains committed to the continued use of the following exterior space management measures:

- A state-of-the-art golf course irrigation system to minimize water use;
- Project-wide planting of drought resistant turf grasses and landscaping materials;
- A project-wide water conservation program as discussed in Section 7.2, Water Conservation Efforts;
- A Turfgrass and Integrated Pest Management (IPM) program to protect water quality; and
- An active employee education program promoting state of the art water conservation measures.

10.3.2 Winter Road Maintenance

As discussed in section 5.2.3, chemical de-icing agents will be limited to calcium chloride during snowplowing operations to ensure that water quality is not impacted negatively during winter months of snow and ice. Sand used to manage winter road conditions that is intercepted by and accumulates in functioning deep sump catch basins, water quality swales, and stormwater basins will be removed each spring and disposed of in accordance with acceptable management practices. Section 5.2 (Compliance with DEP Stormwater Management Standards) and Section 5.3 (NPDES Permit Consistency) describe in detail an Operation and Maintenance Plan and other measures to be implemented each spring to ensure proper functioning of the integrated drainage system.